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## (54) PHOTOMASK AND ITS PRODUCTION

### (57)Abstract:

**PURPOSE:** To provide a photomask for forming wirings having fine wiring patterns on the surface of a molding having a three-dimensional structure and a process for producing such photomask.

**CONSTITUTION:** This photomask has a film-like member 4 consisting of a synthetic resin deformed by using heat and pressure so as to meet the molding 1 having the three-dimensional structure and negative patterns 5 or positive patterns of electric circuits formed by subjecting this film-like member 4 to photoetching or screen printing.



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CLAIMS

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[Claim(s)]

[Claim 1] The photo mask characterized by having the film-like member which consists of synthetic resin which deformed using heat and a pressure so that the Plastic solid which has a spacial configuration might be suited, and the negative pattern or positive pattern of an electrical circuit formed in this film-like member by performing photo etching or screen-stencil.

[Claim 2] The manufacture approach of the photo mask characterized by making conversion of the adaptation possible to the Plastic solid which performs photo etching or screen-stencil, forms the negative pattern or positive pattern of an electrical circuit, applies heat and a pressure to the above-mentioned film-like member, and has a spacial configuration in the film-like member which consists of synthetic resin.

[Claim 3] The manufacture approach of the photo mask according to claim 2 which made thick beforehand the part extended by heat and the pressure according to the degree of extension when forming the above-mentioned negative pattern or a positive pattern in the above-mentioned film-like member.

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DETAILED DESCRIPTION

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[Detailed Description of the Invention]

[0001]

[Industrial Application] This invention relates to the photo mask and its manufacture approach for using a photolithography for the front face of Plastic solids, such as plastics which has a spacial configuration, and forming a circuit pattern in it.

[0002]

[Description of the Prior Art] In recent years, wiring objects, such as the injection-molding circuit board, injection-molding passive circuit elements, etc. which prepared the circuit pattern of an electrical circuit in the front face of a plastics Plastic solid, are developed, and it is expected that the formation of small lightweight and assembly rationalization are brought about.

[0003] It is the description that this does not form a metal pattern in the front face of the Plastic solid which has a spacial configuration as indicated by JP,63-50482,A and JP,1-207989,A, and it is not monotonously limited like the conventional printed-circuit board, and can deal with various configurations.

[0004] There is a method of using a photolithography as an approach of forming a three-dimensional wiring object.

[0005] (1) Form plating resist in the shape of a circuit pattern on a plastics Plastic solid. How to perform nonelectrolytic plating to the exposed part of plastics, and form a metal layer (2) Etching resist is formed in the shape of a circuit pattern on the metal layer uniformly formed on the plastics Plastic solid. Approach etching removes the exposed part of a metal layer (3) A photosensitive catalyst is uniformly applied on a plastics Plastic solid. carry out using any of approach plating resist which forms a metal layer in the part exposed in the shape of a circuit pattern, etching resist, and a photosensitive catalyst -- it is necessary to give pattern-like exposure to a photoresist or a photosensitive catalyst, and, for that purpose, the photograph-approach is used. That is, it is made to stick to a photoresist etc. and lets a mask (photo mask) pass (projecting a mask image by the case), and it exposes to a photoresist etc., it is exposed, and a resist is formed by the development, or a metal is deposited.

[0006]

[Problem(s) to be Solved by the Invention] However, since solidification of an electrical circuit has a difficult problem in fact, the actual condition is that formation of the microwave circuit by the exposing method is not progressing. Utilization is as difficult as especially whenever [ solid ] being large (a configuration being complicated). It is mentioned that an electrical circuit pattern is detailed as the big cause, and manufacture of the photo mask of a three-dimensional configuration is difficult. For example, when the quality of the material of a photo mask is a metal, it is difficult to process an electrical circuit three-dimensional and detailed moreover. Since the part inside a circuit pattern and the outside part are completely separated when an electrical circuit is furthermore a closed system, it is difficult to hold both.

[0007] Moreover, solidification is difficult, although detailed-izing of a circuit is easy when it will perform photo etching etc. in the case of films, such as polyester, or a sheet, if the quality of the material is a plane.

[0008] Then, the purpose of this invention solves the above-mentioned technical problem, and is to offer the photo mask and its manufacture approach for forming the wiring object which has a detailed circuit pattern in the front face of the Plastic solid which has a spacial configuration.

[0009]

[Means for Solving the Problem] This invention is equipped with the film-like member which consists of synthetic resin which deformed using heat and a pressure so that the Plastic solid which has a spacial configuration might be suited, and the negative pattern or positive pattern of an electrical circuit formed in the film-like member by performing photo etching or screen-stencil in order to attain the above-mentioned purpose.

[0010] Conversion of the adaptation of this invention is made possible to the Plastic solid which performs photo etching or screen-stencil, forms the negative pattern or positive pattern of an electrical circuit, applies heat and a pressure to a film-like member, and has a spacial configuration in the film-like member which consists of synthetic resin.

[0011] In case this invention forms the above-mentioned negative pattern or a positive pattern in a film-like member in addition to the above-mentioned configuration, it may make thick beforehand the part extended by heat and the pressure according to the degree of extension.

[0012]

[Function] It softens by applying heat to the film-like member which consists of synthetic resin with which photo etching or screen-stencil was performed, and the negative pattern or positive pattern of an electrical circuit was formed according to the above-mentioned configuration, and by applying a pressure, it can form so that it may stick to the front face of the Plastic solid which a film-like member deforms easily and has a spacial configuration. Thus, by exposing with the obtained photo mask, the exposure side which becomes an office computer baton is lost, and the wiring object which has a detailed circuit pattern is acquired.

[0013] Especially polyester is desirable although the photo mask of this invention has the synthetic resin of transparency generally used, for example, polyester, a polyamide, acrylic resin, a polycarbonate, styrene resin, an epoxy resin, silicone resin, urethane resin, etc. as synthetic resin used as the ingredient of a photo mask.

[0014] Moreover, press forming can be used for the photo mask of this invention for applying heat and a pressure to the film-like member or sheet-like member which formed the pattern of an electrical circuit beforehand. It is desirable to design the dimension of the pattern of an electrical circuit beforehand in consideration of the deformation produced in the case of press forming.

[0015] The photo mask of this invention may divide a photo mask into two or more parts, when a configuration is complicated.

[0016] The photo mask of this invention is applicable to both a positive type and a negative mold.

[0017]

[Example] Hereafter, one example of this invention is explained in full detail based on an accompanying drawing.

[0018] First, the plastics Plastic solid with which the pattern of an electrical circuit is formed in the front face is described.

[0019] Drawing 2 is the external view of the plastics Plastic solid exposed with the photo mask of this invention.

Drawing 2 (a) is the top view, and drawing 2 (b) is the side elevation.

[0020] 1 is the plastics Plastic solid fabricated by injection molding. Polyplastics Vectra C-810 was used as an ingredient of plastics Plastic solid 1. This is the liquid crystal polymer of the plating grade which contains a glass fiber and an inorganic bulking agent 50% of the weight. Cleaning processing of the front face of plastics Plastic solid 1 is carried out with a conventional method, after carrying out surface roughening and carrying out catalyst grant by being immersed in a pottasium hydroxide solution with a temperature of about 60 degrees C for about 30 minutes, non-electrolytic copper plating is performed to the whole surface by the catalyst accelerator method, and the copper of about 30-micrometer thickness is deposited. It covered with the photoresist, after giving electropainting to this copper layer. As a photoresist, positive type electrodeposition etching resist (photograph EDP[ by Nippon Paint Co., Ltd. ]- 1000) was used.

[0021] As shown in this drawing, two or more holes 2 for performing vacuum suction are formed in plastics Plastic solid 1. In addition, while these holes 2 are distant from the part in which the circuit pattern of an electrical circuit is formed, it cannot be overemphasized that it is formed in the part which a photo mask sticks.

[0022] Next, the photo mask of this invention is described.

[0023] Drawing 1 is the appearance perspective view of one example of the photo mask of this invention.

[0024] As shown in this drawing, the photo mask 3 consists of polyester film (or polyester sheet) 4 as a film-like

member with which the cross section was fabricated in three dimensions in the shape of [ of abbreviation KO ] a typeface, and a negative pattern 5 of the electrical circuit formed in polyester film 4.

[0025] Such a photo mask 3 is the following, and is made and manufactured.

[0026] The negative pattern 5 of an electrical circuit as screen-stenciled to polyester film 4 with a thickness of about 50 micrometers (or photo etching) and first shown in it at drawing 3 is formed (although 12 negative patterns 5 are formed by a diagram, not limited to this). It is fabricated by the solid configuration by giving a heat press using the metal mold which is not illustrated to such polyester film 4. In addition, for the conditions of a heat press, about 100 Kgf/cm<sup>2</sup> and temperature was [ the cooldown delay of 250 degrees C and pressurization time amount ] about 2 hours for about 5 minutes. The thing with a cooldown delay longer than pressurization time amount is for preventing that distortion arises at the time of cooling. In addition, drawing 3 is drawing showing the photo mask before processing.

[0027] Drawing 4 is drawing showing the photo mask shown in drawing 1.

[0028] The quantity of light of light 6 is about 400 mJ/cm<sup>2</sup>, making it stick by performing vacuum suction through a hole 2 from under plastics Plastic solid 1, after carrying the photo mask 3 shown in drawing 1 on plastics Plastic solid 1 shown in drawing 2. It exposes using the light source 7 of plurality (not limited although it is four pieces by a diagram.) so that it may become. The light source 7 is a source of the scattered light, and used the ultra-high-voltage mercury-vapor lamp of a non-electrode mold.

[0029] If the photoresist of the front face of plastics Plastic solid 1 is developed about 30 seconds with meta-silic acid soda 1% after exposure for 1 minute, etching resist is formed only in the exposed part and it etches with a ferric-chloride solution, the wiring object 9 with which the circuit pattern 8 as shown in drawing 5 was formed will be acquired. Etching resist is removed after etching termination. In addition, drawing 5 is the external view of the wiring object formed with the photo mask of this invention. Drawing 5 (a) is the top view, and drawing 5 (b) is the side elevation.

[0030] Next, an operation of an example is described.

[0031] It softens by applying heat to the polyester film 4 which consists of synthetic resin with which it screen-stenciled (or photo etching), and the negative pattern (or positive pattern) 5 of an electrical circuit was formed, and by applying a pressure, it can form so that it may stick to the front face of plastics Plastic solid 1 which polyester film 4 deforms easily and has a spacial configuration. Thus, by exposing with the obtained photo mask 3, the exposure side which becomes an office computer baton is lost, and the wiring object 9 which has the detailed circuit pattern 8 is acquired.

[0032] Since it had the film-like member which consists of synthetic resin which deformed using heat and a pressure, and the negative pattern or positive pattern of an electrical circuit formed in the film-like member by performing photo etching or screen-stencil according to this example in the above so that the Plastic solid which has a spacial configuration might be suited, the photo mask for forming a detailed circuit pattern in the front face of the Plastic solid which has a spacial configuration can be formed.

[0033] In addition, although this example explained by the case where a negative pattern is formed in polyester film, it is not limited to this and a positive pattern may be formed. Moreover, in case a negative pattern or a positive pattern is formed in a film-like member, the part extended by heat and the pressure may be beforehand made thick according to the degree of extension. In this case, the width of face of a circuit pattern becoming large at the time of extension, or disconnecting is lost.

[0034]

[Effect of the Invention] In short, according to this invention, the following outstanding effectiveness is demonstrated above.

[0035] In case exposure to the photoresist for forming the circuit pattern of an electrical circuit in the front face of the Plastic solid which has a spacial configuration etc. is performed by the contacting method, it is not necessary to prepare a photo mask for every field which requires exposure, and the purpose can be attained with a small number of photo mask from the number of one piece or exposure sides. Therefore, an exposure activity is simplified and the manufacture efficiency of a wiring object improves.

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